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THE NON-NEUTRALITY OF THE ARM'S LENGTH PRINCIPLE WITH IMPERFECT COMPETITION*

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Abstract
The *Arm's Length Principle* (ALP) has been broadly adopted by OECD countries to avoid the use of firms' internal transfer pricing as a device for shifting profits into low tax jurisdictions. While the ALP does not affect market outcomes under perfect competition, we show that under imperfect competition its adoption is non-neutral: a strict (lax) application of the ALP softens competition among subsidiaries (parents). Thus, under imperfect competition regulating transfer pricing optimally requires trading off its impact on market outcomes and tax revenue.

Keywords: Transfer Pricing Regulation, Arm´s Length Principle, Imperfect Competition, Vertical Separation.

JEL Classification: L13, L51, H26

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1 Introduction

International tax authorities have become increasingly aware of the possible use of transfer prices as a device for shifting profits into low tax jurisdictions -see Devereux (2007). Transfer pricing policies have important implications since exports and imports from related parties are a dominant portion of trade flows – see Bernard, Jensen and Schott (2009), and Lanz and Miroudot (2011).

In order to discourage tax shifting activities by multinational firms, most countries follow taxation policies that are based on the OECD's Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations, which recommend that, for tax purposes, internal pricing policies be consistent with the *Arm's Length Principle (ALP)*; i.e., that transfer prices between companies of multinational enterprises for tax purposes be established on a market value basis, thus comparable to transactions between independent (unrelated) parties – see [20]. Tax authorities from all OECD member nations rely on the ALP to protect their revenue base by preventing incomes shifting from one country to another for reasons unrelated to the economic nature of the transactions. We study the consequences of adopting the ALP when markets are imperfectly competitive.[1]

Hirshleifer (1956) shows that the application of the ALP is inconsequential under perfect competition. The simplest version of Hirshleifer's (1956) model assumes a decentralized firm consisting of a *headquarters* and two divisions, the *upstream* and *downstream* divisions. The upstream division produces an intermediate good and supplies it to the downstream division. The downstream division processes this intermediate good and sells it in the final good market. Each division maximizes its own profits ignoring the impact of its decisions on the profits of the other division or the firm as a whole. The problem of headquarters consists of finding a transfer pricing policy that coordinates the decisions of the two divisions so that consolidated

[1] Under the ALP firms are free to charge their subsidiaries either the same or different prices to those used for tax purposes, i.e., firms may keep either one set of books or two sets of books. Lemus and Moreno (2019) provides an analysis of firms' strategic incentives for choosing either alternative, and shows that under broad conditions keeping one set of books is an equilibrium. Here we assume that adopting the ALP leads parent firms to keep one set of books, thus transferring the good to their subsidiaries at market prices.

profits are maximized. The efficient level of internal trade can be implemented by setting transfer prices at the opportunity cost of the intermediate good. If there is a competitive market for the intermediate good, the opportunity cost of the intermediate good is equal to the market price. If no market exists, the optimal transfer price equals the marginal cost of the intermediate good. Thus, setting the transfer price equal to the market price is consistent with the Arm's Length Principle, and leads to an efficient allocation of resources. Hirshleifer's result depends crucially on the assumption that the intermediate good market is perfectly competitive. As we shall see, under imperfect competition the *ALP* significantly distorts the resource allocation (as well as firms' tax liabilities).

In this paper, abstracting from issues arising due to differences on tax rates in each jurisdiction, we examine the consequences of adopting transfer pricing policies adhering to the *ALP* under imperfect competition and vertical separation. (If firms are vertically integrated, then transfer pricing policies are irrelevant.) In our setting parents compete in quantities in a home market and set the prices at which they sell the good to their subsidiaries (either directly or indirectly via their output choices), which in turn compete in quantities in an external market. As customary, we assume that parents maximize consolidated profits, while subsidiaries maximize their own profits -see Gal-Or (1993).

Contrary to the conventional wisdom that views regulatory constraints as impediments to effective management, our results suggest that regulatory restrictions leading parent firms to set transfer prices at market value may serve as a precommitment device, thus playing a strategic role beneficial to firms: The Arm's Length Principle serves to credibly convey to external parties that the related party price is above marginal cost, ensuring commitment and observability.

In a similar setting, Arya and Mittendorf (2008) analyze transfer pricing policies as strategic responses to external competition. They show that under the *ALP* excessive home market prices depress external production due to double marginalization, making parents more aggressive in the home market. However, they do not recognize that the *ALP* leads to greater transfer prices, and thereby mitigates the prisoner's dilemma in transfer pricing (i.e., the *ALP* allows parents to internalize the impact their output decisions on the transfer price of their subsidiary and their subsidiary's rival).

In the absence of the *ALP*, it has been established that vertical separation intensifies or alleviates competition depending on the nature of the oligopolistic competition: When firms compete in prices, vertical separation softens competition, whereas when firms compete in quantities vertical separation induces firms to compete more aggressively – see Vickers (1985), Fershtman and Judd (1987), Sklivas (1987), Alles and Datar (1998). When the adoption of the *ALP* leads to market based transfer pricing, our results provide a rationale for vertical separation also when firms compete in quantities. Göx (2000) and Dürr and Göx (2011) show that when firms compete in prices, the *ALP* reinforces the effect of vertical separation on softening competition. Contrary to Göx's (2000) claim that this result does not "... carry over to the case of quantity competition because quantities are strategic substitutes...," our results show the *ALP* softens competition even in this case. Moreover, quantity competition provides a reduced form model for the analysis of more complex forms of imperfect competition; e.g., capacity choice followed by some kind of price competition – see Kreps and Scheinkman (1983) and Moreno and Ubeda (2006).

In our framework there are two markets, which we refer to as the Latin market and the Greek market. There are two firms engaging in Cournot competition in the Latin market. These firms have subsidiaries, which in turn engage in Cournot competition in the Greek market. We begin by considering two alternative transfer pricing schemes for intra-firm transactions. Since competition in the Latin market provides a market price to impose on comparable market transactions, we study *market based transfer pricing* (MB) as the equivalent to the *ALP* as the OECD recommends.[2] Alternatively, we consider transfer pricing not linked to the Latin market, i.e., *non-market based transfer pricing* (NMB). We show that MB transfer pricing typically leads to a lower total surplus, and may lead to larger profits, than NMB transfer pricing.

[2]Choe and Matsushima (2013) examine the effect of the *ALP* on dynamic competition in imperfectly competitive markets and show that the *ALP* results in more stable tacit collusion. They consider a vertically related market with two upstream firms which supply to their downstream affiliates and other unrelated buyers in the downstream market. The authors consider the price upstream firms charge to unrelated buyers as the comparable uncontrolled price for applying the *ALP*. In our setting, the price in the home market provides a reliable measure of an arm's length result.

Under NMB transfer pricing a parent's decisions of how much to produce in the Latin market and what transfer price to charge to its subsidiary are independent. In equilibrium, parents set transfer prices below marginal cost in an attempt to gain a Stackelberg advantage in the Greek market; i.e., both parents act in a Stackelberg fashion. The equilibrium output in the Greek market is greater than the Cournot output, and consolidated profit is below the sum of profits at the Cournot equilibria of both markets. These results reproduce those of Vickers (1985) in our framework.

In contrast, under MB transfer pricing a parent must transfer the good to its subsidiary at the Latin market price. Hence, a parent's output decision must internalize its impact on the transfer price of its subsidiary and its subsidiary's rival. *MB transfer pricing* thus provides parents with an instrument to soften competition in the Greek market. Thus, consolidated profits under MB transfer pricing may be above that under NMB transfer pricing. Hence the Arm's Length Principle provides a rationale for vertical separation.[3] However, total surplus under MB transfer pricing is typically below that under NMB transfer pricing, which raises some questions about the use of the *ALP* as a guideline for regulating transfer prices.

We also consider the consequences of applying the *ALP* less rigorously by studying a variation of the model of MB transfer pricing where parents may introduce *discounts*. Under this scheme of *market based transfer pricing with discounts* (MBD) each parent can compensate the effect of a high price in the Latin market on its subsidiary's cost by applying a discount. Discounts open up the possibility to gain a Stackelberg advantage in the Greek market, bringing back the kind of prisoners' dilemma that firms face under NMB transfer pricing. However, whereas under MBD transfer pricing the equilibrium output in the Greek market is the same as under NMB transfer pricing, the equilibrium output in the Latin market is less competitive under MBD transfer pricing than under NMB transfer pricing: a parent has an incentive to increase the price in the Latin market by reducing its output and at the same time increase the discount to its subsidiary, thus increasing its subsidiary's

[3] Arya and Mittendorf (2007) provide an alternative rationale for vertical separation in a model in which subsidiaries use two inputs, one that is produced internally and another one that is purchased from an external supplier. They observe that delegating quantity decisions to a subsidiary results in a lower price from the external supplier, overcompensating the negative effect on profits of transfer prices for the internal input above marginal cost.

rival transfer price without affecting the transfer price of its own subsidiary. These incentives lead to a smaller output and a smaller total surplus in the Latin market than under NMB.

In summary, a transfer pricing policy consistent with the Arm's Length Principle is likely to induce a surplus loss relative to the NMB transfer pricing. Thus, contrary to common wisdom based on competitive models, under imperfect competition the adoption of the *ALP* is non-neutral, but has a significant impact on market outcomes as it softens competition either in the external market (when it is applied rigorously) or in the home market (when its application is laxer).[4]

The paper is organized as follows. Section 2 introduces the basic setup. Section 3 derives results for NMB transfer pricing. Section 4 provides an equilibrium analysis of MB transfer pricing, and compares the properties of equilibrium under the two transfer pricing schemes. Section 5 studies the impact of introducing discounts into the MB transfer pricing scheme. Section 6 concludes.

2 Model and Preliminaries

A good is sold in two markets, which we refer to as the Latin market and the Greek market. The inverse demands in the Latin and Greek markets are $d(q) = \max\{0, a - bq\}$ and $\delta(\chi) = \max\{0, \alpha - \beta\chi\}$, respectively, where a, b, α, and β are positive real numbers. Assuming linear demands simplifies the analysis and facilitates interpreting the results. Comparing the constant terms in each demand (i.e., the parameters a and α) allows us to consider the impact of differences in the maximum willingness to pay in each market. The parameter $u := a/\alpha$ is a proxy for the maximum willingness to pay in the Latin market relative to that of the Greek market. Differences in the slope of the demands (i.e., of the parameters b and β) capture the impact of differences in the market size – the demand is greater the smaller the slope. The parameter $s := \beta/b$ is a proxy for the size of the Greek market relative to that of the Latin market.

There are two firms producing the good at the same constant marginal cost, which

[4] Keuschnigg and Devereux (2013) develop a model of firms offshoring intermediate inputs that are subject to financial frictions. They find that the *ALP* distorts multinational activity by reducing debt capacity and investment of foreign affiliates, and may lead to a surplus loss.

is assumed to be zero without loss of generality. Firms engage in Cournot competition in the Latin market, and have subsidiaries which in turn engage in Cournot competition in the Greek market. Each subsidiary receives the good from its parent firm at a transfer price. Parent firms seek to maximize consolidated profits; since the cost of production is zero, consolidated profits are just the sum of revenues of the parent and the subsidiary. A subsidiary maximizes its own profits, which is the difference between its revenue and its cost. A subsidiary' unit cost is just its transfer price. We identify the parent and subsidiary firms with the same subindex $i \in \{1, 2\}$.

Clearly, if parents do not delegate but rather compete in quantities in the external market as well, then in equilibrium firms produce their Cournot output in each market, and transfer pricing policies are irrelevant.

Consider a market where the inverse demand is $D(Q) = \max\{0, A - BQ\}$. If the cost of production is zero and q units of output are supplied, then the consumer and total surpluses generated in the market are, respectively,

$$\left(\frac{B}{2}q^2, Aq - \frac{B}{2}q^2\right), \tag{1}$$

which increase with q on $(0, A/B)$. Throughout we focus attention in total surplus, which we refer to simply as surplus. If there are two firms in the market producing the good with constant marginal costs $(c_1, c_2) \in \mathbb{R}^2_+$, then in the Cournot equilibrium the price, and firm's $i \in \{1, 2\}$ output and profit are, respectively,

$$\left(\frac{A + c_1 + c_2}{3}, \frac{A - 2c_i + c_j}{3B}, \frac{(A - 2c_i + c_j)^2}{9B}\right). \tag{2}$$

And if the market is monopolized by a single firm whose constant marginal cost is $c \in \mathbb{R}_+$, then in equilibrium the price, and the firm's output and profit are, respectively,

$$\left(\frac{A + c}{2}, \frac{A - c}{2B}, \frac{(A - c)^2}{4B}\right). \tag{3}$$

Applying the formulae (1) and (2) we readily calculate the prices (p^C, π^C), the firms' outputs (q^C, χ^C), and the surpluses (W^C, Ω^C) in Cournot equilibrium of the Latin and Greek markets, which are given by

$$(p^C, q^C, W^C) = \left(\frac{a}{3}, \frac{a}{3b}, \frac{a^2}{9b}\right), \; (\pi^C, \chi^C, \Omega^C) = \left(\frac{\alpha}{3}, \frac{\alpha}{3\beta}, \frac{\alpha^2}{9\beta}\right), \tag{4}$$

as well as in the consolidated and subsidiary's profits $(\bar{\Pi}^C, \Pi^C)$, which are given by

$$(\bar{\Pi}^C, \Pi^C) = (\frac{4a^2}{9b} + \frac{4\alpha^2}{9\beta}, \frac{4\alpha^2}{9\beta}). \tag{5}$$

Likewise, applying the formulae (1) and (3) we obtain the he prices (p^M, π^M), the firm's outputs (q^M, χ^M) and the surpluses (W^M, Ω^M) in the monopoly equilibrium of the Latin and Greek markets, which are given by

$$(p^M, q^M, W^M) = \left(\frac{a}{2}, \frac{a}{2b}, \frac{a^2}{4b}\right), \ (\pi^M, \chi^M, \Omega^M) = \left(\frac{\alpha}{2}, \frac{\alpha}{2\beta}, \frac{\alpha^2}{4\beta}\right), \tag{6}$$

as well as the consolidated and subsidiary's profits $(\bar{\Pi}^M, \Pi^M)$, which are given by

$$(\bar{\Pi}^M, \Pi^M) = (\frac{3a^2}{8b} + \frac{3\alpha^2}{8\beta}, \frac{3\alpha^2}{8\beta}). \tag{7}$$

3 Non-Market Based Transfer Pricing

Assume that the parent firms simultaneously decide the transfer prices they charge to their subsidiaries, knowing that these firms will engage in Cournot competition in the Greek market; i.e., each parent firm $i \in \{1, 2\}$ sets its transfer price $r_i \in \mathbb{R}$ so as to maximize consolidated profits. (Of course, a parent firm may provide the good to a subsidiary at a subsidized cost, which implies, since the unit cost is zero, that transfer prices may be negative.) The equilibrium under this scheme of non-market based (NMB) transfer pricing is determined as follows.

For (r_1, r_2), the equilibrium in the Greek market is that of a Cournot duopoly where firms' constant marginal costs are (r_1, r_2); i.e., the output of firm $i \in \{1, 2\}$ is

$$\chi_i^* = \bar{\chi}_i(r_1, r_2) = \frac{\alpha - 2r_i + r_j}{3\beta}.$$

Thus, parent i solves the problem

$$\max_{(q_i, r_i) \in \mathbb{R}_+ \times \mathbb{R}} d(q_1 + q_2)q_i + \delta(\bar{\chi}_1(r_1, r_2) + \bar{\chi}_2(r_1, r_2))\bar{\chi}_i(r_1, r_2).$$

Since parent i's choice of transfer prices r_i does not affect its revenue in the Latin market, nor its output decisions in the Latin market q_i affect its revenue in the Greek market. Hence, these two decisions can be treated independently; i.e., q_i (r_i) is chosen to maximize revenue in the Latin (Greek) market. Thus, the equilibrium outcome in the Latin market is just the Cournot equilibrium outcome.

We calculate the equilibrium outcome in the Greek market. Parent i chooses its transfer price r_i so as to maximize its subsidiary's revenue in the Greek market, $\delta\left(\bar{\chi}_1\left(r_1,r_2\right)+\bar{\chi}_2\left(r_1,r_2\right)\right)\bar{\chi}_i\left(r_1,r_2\right)$. Hence, parent i's reaction to the transfer price set up by its competitor, r_j, is

$$R_i(r_j) = -\frac{r_j+\alpha}{4}.$$

Therefore, the equilibrium transfer prices are

$$r_1^* = r_2^* = -\frac{\alpha}{5} = r^{NMB}.$$

Substituting these values into the equation for $\bar{\chi}_i\left(r_1,r_2\right)$ and using (2) we get the subsidiaries' outputs

$$\chi^{NMB} := \bar{\chi}_1\left(r_1^*,r_2^*\right) = \bar{\chi}_2\left(r_1^*,r_2^*\right) = \frac{2\alpha}{5\beta} = \frac{6}{5}\chi^C.$$

Hence the equilibrium price in the Greek market is

$$\pi^{NMB} := \delta\left(2\chi^{NMB}\right) = \frac{\alpha}{5} = \frac{3}{5}\pi^C.$$

Consolidated profit is

$$\bar{\Pi}^{NMB} = p^C q^C + \pi^{NMB}\chi^{NMB} = \frac{4a^2}{9b} + \frac{18}{25}\Pi^C < \bar{\Pi}^C, \tag{8}$$

while each subsidiary's profit is

$$\Pi^{NMB} = \left(\pi^{NMB} - r^{NMB}\right)\chi^{NMB} = \frac{36}{25}\Pi^C.$$

And surpluses in the Latin and Greek markets are $W^{NMB} = W^C$, and

$$\Omega^{NMB} = \left(\alpha - \frac{\beta}{2}\left(2\chi^{NMB}\right)\right)2\chi^{NMB} = \frac{27}{25}\Omega^C.$$

We summarize these results in the following proposition.

Proposition 1. *Under NMB transfer pricing:*

(1.1) The equilibrium output in the Latin market is the Cournot output, i.e.,

$$q^{NMB} = q^C.$$

(1.2) The equilibrium output in the Greek is above the Cournot output, i.e.,

$$\chi^{NMB} = \frac{6}{5}\chi^C > \chi^C.$$

(1.3) The subsidiaries' profits are above, while consolidated profits are below, the Cournot equilibrium of the two markets, i.e.,

$$\bar{\Pi}^{NMB} = \frac{4a^2}{9b} + \frac{18}{25}\Pi^C < \bar{\Pi}^C, \ \textit{and} \ \Pi^{NMB} = \frac{36}{25}\Pi^C > \Pi^C.$$

(1.4) The surpluses in the Latin and Greek markets are

$$(W^{NMB}, \Omega^{NMB}) = (W^C, \frac{27}{25}\Omega^C).$$

Thus, the total surplus is above the total surplus at the Cournot equilibria.

The strategic considerations behind this result are clear: delegating output decision to subsidiaries induces parents to compete more aggressively in the Greek market, relative to a setting in which parents exercise direct control of the subsidiary's output. By reducing its transfer price below marginal cost, parents attempt to gain a kind of Stackelberg leader status, creating a sort of prisoners' dilemma situation. As a consequence, the equilibrium outcome in the Greek market is more efficient than the Cournot outcome. Analogous results are found by Vickers (1985), Judd and Fershtman (1987), Sklivas (1987), and Alles and Datar (1998).

4 Market Based Transfer Pricing

In this section, we assume, consistently with the Arm's Length Principle, that subsidiaries buy the good from parents at the price at which the good trades in the Latin market, which is known to the firms competing in the Greek market at the time of making output decisions. In this setup, parents act as "leaders" anticipating the reactions of subsidiary firms. The equilibrium under this scheme of market based (MB) transfer pricing is determined as follows.[5]

Assuming that the price in the Latin market is $p \geq 0$, each subsidiary $i \in \{1, 2\}$ chooses its output χ_i to solve the problem

$$\max_{\chi_i \in \mathbb{R}_+} \ (\delta\left(\chi_1 + \chi_2\right) - p)\chi_i.$$

[5] Dürr and Göx (2011) assume that firms can arbitrarily choose a transfer price from an allowable exogenous range of *ALP prices*, withstanding a possible examination of authorities in the two markets. In the next section, we consider a lax application of the *ALP* where effective transfer prices are determined endogenously.

Here p is the constant marginal cost of the subsidiary firms. Using the formulae (2), we calculate equilibrium outputs for $p \geq 0$ as

$$\chi_1^* = \chi_2^* = \hat{\chi}(p) = \frac{\alpha - p}{3\beta}.$$

Parents, anticipating the outputs in the Greek market, choose their output q_i in order to solve

$$\max_{q_i \in \mathbb{R}_+} d(q_1 + q_2)q_i + \delta(\hat{\chi}_1(d(q_1 + q_2)) + \hat{\chi}_2(d(q_1 + q_2)))\hat{\chi}_i(d(q_1 + q_2)).$$

Solving the system formed by the parents' reaction functions for the interior equilibrium of the Latin market, we obtain the output of each parent q^{MB}, which is given by

$$q^{MB} = \frac{(4b + 9\beta)a - b\alpha}{b\,(8b + 27\beta)} = \frac{\alpha\,(u - f(s,u))}{2b}, \tag{9}$$

where

$$f(s,u) := \frac{9su + 2}{8 + 27s},$$

and the market price p^{MB}, which is given by

$$p^{MB} = \alpha f(s,u). \tag{10}$$

Using the value of p^{MB} as the cost of subsidiaries, we calculate the equilibrium in the Greek market. In this equilibrium, each subsidiary's output χ^{MB} is

$$\chi^{MB} = \frac{\alpha - p^{MB}}{3\beta} = \frac{(2b + 9\beta)\,\alpha - 3\beta a}{\beta(8b + 27\beta)} = (1 - f(s,u))\,\frac{\alpha}{3\beta} = (1 - f(s,u))\,\chi^C, \tag{11}$$

and the price is

$$\pi^{MB} = \alpha - \beta\left(2\chi^{MB}\right) = \frac{\alpha}{3}\,(1 + 2f(s,u))\,. \tag{12}$$

For the equilibrium to be interior we must have

$$(4b + 9\beta)\,a - b\alpha > 0,$$

i.e.,

$$u > \frac{1}{4 + 9s} := l(s),$$

and

$$(9\beta + 2b)\,\alpha - 3\beta a > 0,$$

i.e.,

$$u < 3 + \frac{2}{3s} := g(s).$$

Thus, equilibrium is interior whenever

$$l(s) < u < g(s), \tag{13}$$

holds. The thin and thick curves in Figure 1 below display the graphs of the functions l and g, respectively. For parameter constellations (s, u) lying between these curves the equilibrium is interior.

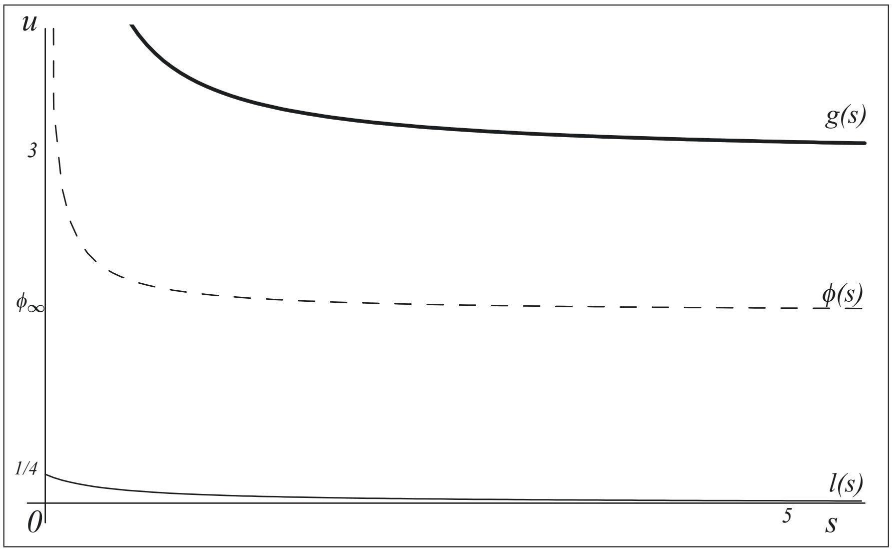

Figure 1. Total profits under MB and NMB transfer pricing.

If $u \geq g(s)$, then firms' equilibrium outputs are $q^{MB} = q^C$ and $\chi^{MB} = 0$; that is, for parameter constellations lying above the thick curve of Figure 1 double marginalization leads to a complete shutdown of the Greek market. And if $u \leq l(s)$, then firms' equilibrium outputs are $q^{MB} = 0$ and $\chi^{MB} = (\alpha - a)/3\beta$; that is, for parameter constellations below the thin line of Figure 1, it pays to shut down the Latin market in order to soften competition in the Greek market among subsidiaries as much as possible.

Assuming that (13) holds, so that both markets are active, and using again (4), we can rewrite the expression for firms' output in the Latin market (9) as

$$q^{MB} = q^C + \frac{4\alpha}{3\,(8b + 27\beta)} \left(u - \frac{3}{4} \right).$$

Likewise, using equations (4) and (6) we can write the expression for firms' output in the Greek market (11) as

$$\begin{aligned}\chi^{MB} &= \chi^{C} - \frac{9a\beta + 2b\alpha}{3\beta\left(8b + 27\beta\right)} \\ &= \frac{\chi^{M}}{2} - \frac{3\alpha}{\left(8b + 27\beta\right)}\left(u - \frac{3}{4}\right).\end{aligned}$$

Thus, under MB transfer pricing whether the output in the Latin market is above or below the Cournot output (which is also their output under NMB pricing by Proposition 1) depends on the sign of $u - 3/4$. This term is positive whenever the maximum willingness to pay in the Latin market relative to that in the Greek market is sufficiently large (at least 75%), and it is negative otherwise. However, the output in the Greek market is always below the Cournot output (and therefore, it is below the output under NMB transfer pricing by Proposition 1). Note also that double marginalization imposed by MB transfer pricing leads to an output in the Greek market that is below the monopoly output when $u > 3/4$.

We have

$$\frac{\partial q^{MB}}{\partial \beta} = -\frac{36\alpha}{\left(8b + 27\beta\right)^{2}}\left(u - \frac{3}{4}\right),$$

and

$$\frac{\partial \chi^{MB}}{\partial b} = \frac{24\alpha}{\left(8b + 27\beta\right)^{2}}\left(u - \frac{3}{4}\right).$$

Hence, the signs of these derivatives are also determined by the sign of $u - 3/4$. If $u > 3/4$, then the output in the Latin (Greek) market decreases (increases) with β (b). It is easy to see why: only if the willingness to pay in the Latin market is sufficiently large relative to that of the Greek market (i.e., $u > 3/4$), it is worthwhile responding to an increase of the Greek market size (i.e., a smaller β) with an increase of the output in the Latin market, thus reducing the transfer price and avoiding a large reduction of the sales of the subsidiary.

The equilibrium output in the Latin market satisfies

$$\lim_{\beta \to 0} q^{MB} = q^{C} + \frac{\alpha}{6b}\left(u - \frac{3}{4}\right) := q_{0}^{MB},$$

and

$$\lim_{\beta \to \infty} q^{MB} = q^{C}.$$

Thus, as the size of the Greek market becomes large (i.e., β becomes small), the output in the Latin market is above or below the Cournot output depending on the sign of $u - 3/4$. If $u > 3/4$, then parents' incentives to increase their output in order to alleviate double marginalization remains as the size of the Greek market becomes arbitrarily large. When $u < 3/4$, however, parents reduce their output in the Latin market as a way to commit to high prices in the Greek market. Of course, as the size of the Greek market becomes arbitrarily small (i.e., β approaches infinity), parents tend to ignore the double marginalization problem (as the profits in this market become negligible), and focus on the impact on their output decision in the Latin market, and their output approaches the Cournot output, independently of the sign of $u - 3/4$.

The equilibrium output in the Greek market satisfies

$$\lim_{b\to\infty} \chi^{MB} = \frac{\chi^M}{2},$$

and

$$\lim_{b\to 0} \chi^{MB} = \chi^C - \frac{a}{9\beta} = \frac{\chi^M}{2} - \frac{\alpha}{9\beta}\left(u - \frac{3}{4}\right) := \chi_0^{MB}.$$

Thus, as the size of the Latin market becomes arbitrarily small (i.e., b approaches infinity), the revenues in this market become negligible, and parents' output decisions mainly serve the purpose of committing to high prices in the Greek market.

Interestingly, MB transfer pricing allows parents to attain perfect cooperation (i.e., they are able to sustain the monopoly outcome) when b approaches infinity. In this case, MB transfer pricing is merely an instrument to avoid competition in the Greek market. When the size of the Latin market becomes arbitrarily large (i.e., b approaches zero), however, revenues mainly come from the Latin market and therefore, parents tend to ignore the impact of double marginalization in the Greek market, producing the Cournot output in the Latin market. Double marginalization leads to an output below the Cournot output, and has its worst effects whenever $u > 3/4$, in which case output falls even below the monopoly output.

We summarize these results in Proposition 2.

Proposition 2. *Under MB transfer pricing:*

(2.1) If $1/(4+9s) < u < 3+2/3s$, *then the equilibrium is interior. In equilibrium: The output in the Latin market* q^{MB} *is above or below the Cournot output, and decreases*

or increases with the size of the Greek market β depending on whether u is above or below 3/4, i.e.,

$$q^{MB} \gtreqless q^C = q^{NMB} \text{ and } \frac{\partial q^{MB}}{\partial \beta} \lesseqgtr 0 \text{ if and only if } u \gtreqless \frac{3}{4}.$$

The output in the Greek market χ^{MB} is below the Cournot outcome, i.e.,

$$\chi^{MB} = (1 - f(s,u))\, \chi^C < \chi^C < \chi^{NMB},$$

and is below or above the monopoly output and increases or decreases with the size of the Latin market b depending on whether u is above or below 3/4, i.e.,

$$\chi^{MB} \lesseqgtr \frac{\chi^M}{2} \text{ and } \frac{\partial \chi^{MB}}{\partial b} \gtreqless 0 \text{ if and only if } u \gtreqless \frac{3}{4}.$$

Further, as β becomes large q^{MB} approaches q^C, and as β becomes small q^{MB} approaches q_0^{MB}, where $q_0^{MB} \gtreqless q^C$ whenever $u \gtreqless 3/4$. And as b becomes large χ^{MB} approaches $\frac{\chi^M}{2}$, and as b becomes small χ^{MB} approaches $\chi_0^{MB} < \chi^C$, where $\chi_0^{MB} \gtreqless \frac{\chi^M}{2}$ whenever $u \lesseqgtr 3/4$.

(2.2) If $u \leq 1/(4+9s)$, then equilibrium outputs are $q^{MB} = 0$ and $\chi^{MB} = (\alpha - a)/3\beta$. And if $u \geq 3 + 2/3s$, then equilibrium outputs are $q^{MB} = q^C$ and $\chi^{MB} = 0$.

Let us analyze the profits under MB transfer pricing. Each subsidiary's equilibrium profit can be calculated as

$$\Pi^{MB} = (\pi^{MB} - p^{MB})\chi^{MB} = (1 - f(s,u))^2 \frac{\alpha^2}{9\beta} = (1 - f(s,u))^2\, \Pi^C.$$

Hence

$$\Pi^{MB} - \Pi^{NMB} = (1 - f(s,u))^2\, \Pi^C - \frac{36}{25}\Pi^C = \left(f(s,u)^2 - 2f(s,u) - \frac{11}{25} \right) \Pi^C.$$

In the above expression, the quadratic polynomial in parenthesis is negative when $f(s,u)$ is in the interval $(-1/5, 11/5)$. Since $f(s,u) > 0$, this implies that $\Pi^{MB} < \Pi^{NMB}$ whenever $f(u,s) < 11/5$, or equivalently $u < 99/15 + 26/(15s)$. This later inequality is implied by the inequality $u < g(s) = 3 + 2/(3s)$, necessary for equilibrium to be interior. Hence, in (an interior) equilibrium $\Pi^{MB} < \Pi^{NMB}$. As for corner equilibria, when $u \geq g(s)$ the subsidiaries output is zero; hence $\Pi^{MB} = 0 < \Pi^{NMB}$.

And when $u \leq l(s) = 1/(4+9s)$ the subsidiaries' outputs and profit are $\chi^{MB} = (\alpha - a)/3\beta$ and $\Pi^{MB} = (\alpha - a)^2/9\beta$; therefore

$$\Pi^{MB} - \Pi^{NMB} = \left(u^2 - 2u - \frac{11}{25}\right)\Pi^C < 0$$

since $u < 1/(4+9s) < 11/5$. Thus, the subsidiaries profits under MB transfer pricing are below their profits under NMB transfer pricing for all parameter constellations.

In an interior equilibrium firms' consolidated profits can be calculated using (8) as

$$\bar{\Pi}^{MB} = \bar{\Pi}^{NMB} + \frac{b^2\alpha^2 R(s,u)}{64b^2\beta + 432b\beta^2 + 729\beta^3},$$

where

$$R(s,u) = -\left(30s^2 + \frac{64}{9}s\right)u^2 + \left(8s + 36s^2\right)u + \frac{567}{25}s^2 + \frac{436}{25}s + \frac{72}{25}.$$

Write

$$\phi(s) = \frac{810s^2 + 180s + \sqrt{2}\,(24+81s)\sqrt{155s^2+36s}}{10s\,(135s+32)},$$

for the single positive value of u that solves $R(s,u) = 0$. Then we have $R(s,u) \gtreqless 0$, and therefore $\bar{\Pi}^{MB} \gtreqless \bar{\Pi}^{NMB}$, whenever $u \lesseqgtr \phi(s)$.

The dashed curve in Figure 1 above displays the function ϕ. (Recall that the thin and thick curves represent the functions l and g, respectively.) For the equilibrium to be interior, the values of s and u must lie between these two curves. Note ϕ is decreasing in s and

$$\lim_{s\to\infty}\phi(s) = \frac{3}{5}\left(1 + \frac{\sqrt{310}}{10}\right) := \phi_\infty \simeq 1.6564.$$

Thus, when equilibrium is interior and u is below ϕ_∞ consolidated profits under MB transfer pricing are greater than under NMB transfer pricing even if the size of the Greek market is small relative to that of the Latin market (i.e., s is large).

We also examine consolidated profits at corner equilibria. When $u \geq g(s)$, then firms' equilibrium outputs are $q^{MB} = q^C = q^{NMB}$ and $\chi^{MB} = 0 < \chi^{NMB}$. Hence consolidated profits are

$$\bar{\Pi}^{MB} = p^{NMB}q^{NMB} < \bar{\Pi}^{NMB}.$$

When $u \leq l(s)$, then firms' equilibrium outputs are $q^{MB} = 0 < q^{NMB}$ and $\chi^{MB} = \frac{(\alpha - a)}{3\beta} < \chi^{C} < \chi^{NMB}$. Hence consolidated profits are

$$\bar{\Pi}^{MB} = \bar{\Pi}^{NMB} + \frac{\alpha^2 \hat{R}}{225\beta},$$

where

$$\hat{R}(s,u) = 7 - 25u\,(2u + su - 1)\,.$$

Hence, we have $\hat{R}(s,u) \gtreqless 0$, and therefore $\bar{\Pi}^{MB} \gtreqless \bar{\Pi}^{NMB}$, whenever

$$u \lesseqgtr \frac{5 + \sqrt{28s + 81}}{20 + 10s} := \hat{\phi}(s).$$

Since

$$l(s) - \hat{\phi}(s) < 0,$$

for all s, then $u \leq l(s)$ implies

$$u < \hat{\phi}(s),$$

and therefore $\bar{\Pi}^{MB} > \bar{\Pi}^{NMB}$.

In summary, for parameter constellations (s,u) for which equilibrium is interior, and lie below (above) the graph of ϕ (the dashed curve in Figure 1) firms' profits under MB transfer pricing are above (below) their profits under NMB transfer pricing. Thus, in corner equilibria that arise when the willingness to pay in the Latin market relative to that of the Greek market u is small (i.e., when $u \leq l(s) < 1/4$) firms' consolidated profits under MB transfer pricing are greater than under NMB, whereas in the corner equilibria that arise when u is large (i.e., when $u \geq g(s) > 3$), firms' consolidated profits under MB transfer pricing are smaller than under NMB transfer pricing. Proposition 3 summarizes our results.

Proposition 3. *Under MB transfer pricing:*
(3.1) The profit of the subsidiaries is below their profits under NMB transfer pricing, i.e., $\Pi^{MB} < \Pi^{NMB}$.
(3.2) Consolidated profits are above or below consolidated profits under NMB transfer pricing depending on whether u is above or below $\phi(s)$; i.e.,

$$\bar{\Pi}^{MB} \gtreqless \bar{\Pi}^{NMB} \text{ if and only if } u \lesseqgtr \phi(s)\,.$$

In particular, if $u < \phi_{\infty} \simeq 1.6564$, *then consolidated profits under market based transfer pricing are above consolidated profits under non-market based transfer pricing.*

Let us study the total surplus under MB transfer pricing. In an interior equilibrium, we calculate the surplus in the Latin market under MB transfer pricing using equation (1) as

$$W^{MB} = W^{NMB} + \frac{8\alpha\left(27a\beta + b\left(4a + 3\alpha\right)\right)}{9\left(8b + 27\beta\right)^{2}}\left(u - \frac{3}{4}\right).$$

Therefore $W^{MB} \gtreqqless W^{NMB}$ whenever $u \gtreqqless 3/4$. Obviously, $\chi^{MB} < \chi^{MB}$ implies $\Omega^{MB} < \Omega^{NMB}$. Thus, in an interior equilibrium the comparison of total surplus under MB and NMB transfer pricing is as follows: if $u \leq 3/4$, then $W^{MB} + \Omega^{MB} < W^{NMB} + \Omega^{NMB}$. If $u > 3/4$, then we have $W^{MB} > W^{NMB}$, but $\Omega^{MB} < \Omega^{NMB}$. Thus, the comparison of total surplus under MB and NMB transfer pricing is ambiguous. We have

$$W^{MB} + \Omega^{MB} = W^{NMB} + \Omega^{NMB} + \frac{2b^{2}\alpha^{2}S(s,u)}{225\beta\left(8b + 27\beta\right)^{2}},$$

where

$$S(s,u) = 25s\left(27s + 16\right)u^{2} - 2700s\left(3s + 1\right)u - 2916s^{2} - 3303s - 756.$$

Write

$$\psi\left(s\right) = \frac{4050s^{2} + 15\left(27s + 8\right)\sqrt{7s\left(16s + 3\right)} + 1350s}{400s + 675s^{2}}.$$

for the solution to the equation $S(s,u) = 0$. Hence $S(s,u) \gtrless 0$, and therefore $W^{MB} + \Omega^{MB} \gtrless W^{NMB} + \Omega^{NMB}$ whenever $u \gtrless \psi\left(s\right)$.

The dashed curve in Figure 2 displays the function ψ. (Here again the thin and thick curves in Figure 2 represents the functions l and g, respectively. Recall that the equilibrium is interior under MB transfer pricing for parameter constellations (s,u) lying between these two curves.)

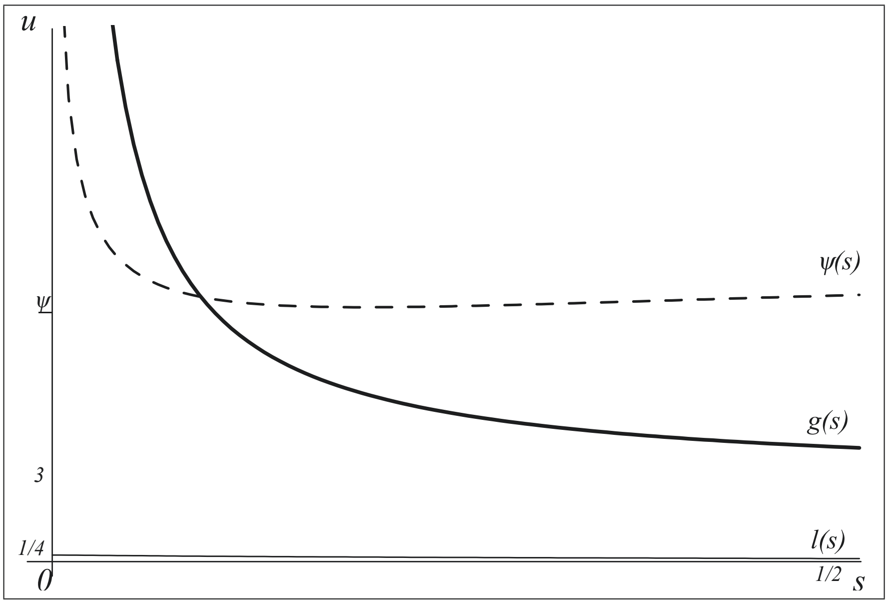

Figure 2. Total welfare under MB and NMB transfer pricing.

The minimum value of ψ is $\underline{\psi} = \frac{27}{20}\sqrt{7} + 6 \simeq 9.5718$. Thus, for $u < \underline{\psi}$ the total surplus under MB transfer pricing is below the total surplus under NMB transfer pricing. Only for parameter constellations (s, u) satisfying $\psi(s) < u < g(s)$ we have

$$W^{MB} + \Omega^{MB} > W^{NMB} + \Omega^{NMB}.$$

As Figure 2 illustrates, these parameter constellations involve a large willingness to pay in the Latin market relative to that of the Greek market u (larger than $249/25 \simeq 9.96$), and a small size of the Greek market relative to that of the Latin market s (smaller than $25/261 \simeq .095$), and form a small subset of the parameter space.

Let us examine the total surplus at corner equilibria. If $u \geq g(s)$, then firms' equilibrium outputs are $q^{MB} = q^C = q^{NMB}$ and $\chi^{MB} = 0 < \chi^{NMB}$, and the total surplus satisfies

$$W^{MB} + \Omega^{MB} = W^{NMB} + 0 < W^{NMB} + \Omega^{NMB}.$$

If $u \leq l(s)$, then firms' equilibrium outputs are $q^{MB} = 0 < q^{NMB}$ and $\chi^{MB} = \frac{(\alpha - a)}{3\beta} < \chi^C < \chi^{NMB}$. Hence $W^{MB} = 0$ and $\Omega^{MB} < \Omega^{NMB}$. Therefore

$$W^{MB} + \Omega^{MB} < W^{NMB} + \Omega^{NMB}.$$

Thus, in every corner equilibrium the total surplus under MB transfer pricing is below the total surplus under NMB transfer pricing.

The total surplus under MB transfer pricing is below the total surplus under NMB transfer pricing except for the small set of parameter constellations (s, u) in the area below the graph of g and above the graph of ψ, i.e., for (s, u) satisfying $\psi(s) < u < g(s)$. As Figure 2 illustrates, for these parameter constellations the increment in surplus due to the increment in output in the Latin market under MB transfer pricing relative to that under NMB transfer pricing, $q^{MB} > q^C = q^{NMB}$, more than compensates the reduction in surplus due to the reduction of the output in the Greek market, $\chi^{MB} < \chi^C < \chi^{NMB}$. Proposition 4 states these results.

Proposition 4. *The total surplus under market based transfer pricing is typically smaller than under non-market based transfer pricing. Specifically, only if* (s, u) *satisfies*

$$\psi(s) < u < g(s)$$

is the total surplus under market based transfer pricing larger than under non-market based transfer pricing. This condition requires that the maximum willingness to pay in the Latin market relative to that of the Greek market u *be large (larger than 9.95) and the size of the Latin market relative to that of the Greek market* s *be small (smaller than 0.095).*

MB transfer pricing provides parent firms with an instrument to limit aggressive competition in the Greek market, and may allow them to induce an outcome close to the monopoly outcome when the size of the Greek market relative to that of the Latin market is large. Of course, since a parent influences its transfer price only via its output decision in the Latin market, competition in this market may be more aggressive than under NMB transfer pricing, provided the maximum willingness to pay in this market is not too small compared to that of the Greek market. For some parameter constellations, consolidated profits under MB transfer pricing are above that under NMB transfer pricing. Thus, under quantity competition the Arm's Length Principle provides a rationale for vertical separation. However, total surplus under MB transfer pricing is typically below that under NMB transfer pricing, which raises some questions about the use of the *ALP* as a guideline for regulating transfer prices.

5 Market Based Transfer Pricing with Discounts

In order to discuss the consequences of a lax application of the *ALP*, we consider an alternative setting where transfer prices are market based, but parents apply *discounts* to their subsidiaries. Such practices are common. Baldenius, Melumad and Reichelstein (2004) argue that this is a frequent practice, which is justified due to cost differences between internal and external transactions. Bernard, Jensen and Schott (2006) examine U.S. international export transaction between 1993 and 2000, and find that prices of U.S. exports are substantially larger than transfer prices for subsidiaries. In addition, they find that the wedge between the market prices and related-party prices is negatively correlated with destination-country corporate tax rates, and positively correlated with both destination-country import tariffs and other characteristics indicating greater market power. Baldenius and Reichelstein (2006) also cite examples of firms adjusting prevailing market prices for internal transfers. Of course, failure to comply with the Arm's Length Principle may result in penalties, which firms may have to optimally trade off. We abstract away from penalties, and focus our analysis on the strategic consequences of a lax application of the *ALP*.

In our setting, each parent firm chooses simultaneously its output in the Latin market as well as the discount that will apply to its subsidiary. Then each subsidiary, knowing the price in the Latin market, its own discount and that of its rival, competes in quantities in the Greek market.[6]

The equilibrium under this scheme of market based transfer pricing with discounts (MBD) is determined as follows. Assuming that the price in the Latin market is $p \in \mathbb{R}_+$ and discounts are $(\theta_1, \theta_2) \in \mathbb{R}^2_+$, each subsidiary $i \in \{1, 2\}$ chooses its output χ_i to solve the problem

$$\max_{\chi_i \in \mathbb{R}_+} (\delta\,(\chi_1 + \chi_2) - (p - \theta_i))\chi_i.$$

Here the term $p - \theta_i$ is the constant marginal cost of subsidiary i. Using the equation (2), we calculate the equilibrium outputs in the Greek market as a function of the

[6] Arya and Mittendorf (2008) study transfer pricing policies as a strategic response to external competition in a similar setting. In their model, however, discounts are set prior to the stage of competition in the Latin market, and serve as a precommitment device. Nevertheless, this device is somewhat contrived since parents must credibly bind themselves to these discounts.

price in the Latin market and the parents' discounts, which are given by

$$\chi_i^* = \tilde{\chi}_i(p, \theta_1, \theta_2) = \frac{\alpha - p + 2\theta_i - \theta_j}{3\beta}.$$

Parent firm i, anticipating the outputs and market price in the Greek market, chooses its outputs q_i and its discount δ_i in order to solve the problem

$$\max_{(q_i,\theta_2)\in\mathbb{R}_+^2} d(q_1+q_2)q_i + \delta(\tilde{\chi}_1\left(d(q_1+q_2), \theta_1, \theta_2\right) + \\ +\tilde{\chi}_2\left(d(q_1+q_2), \theta_1, \theta_2\right))\tilde{\chi}_i\left(d(q_1+q_2), \theta_1, \theta_2\right)$$

Solving the system of equations formed by the first-order conditions for profit maximization of parents 1 and 2 we obtain their outputs and discounts in an *interior* equilibrium. In the Latin market, parents' outputs are

$$q_1^* = q_2^* = \frac{a}{3b} - \frac{\alpha}{15\beta} := q^{MBD},$$

and the market price is

$$d(2q^{NMD}) = \frac{a}{3} + \frac{2}{15}\frac{b\alpha}{\beta} := p^{MBD}, \tag{14}$$

Equilibrium discounts are

$$\theta_1 = \theta_2 = \frac{5a\beta + 2b\alpha + 3\alpha\beta}{15\beta} := \theta^*. \tag{15}$$

and thus, transfer prices are given by

$$p^{MBD} - \theta^* = -\frac{\alpha}{5}.$$

Note that transfer prices are negative, i.e., transfer prices are below marginal cost. Substituting these values into the equation above, we obtain the subsidiaries' outputs

$$\tilde{\chi}_i\left(p^{MBD}, \theta^*, \theta^*\right) = \frac{2}{5}\frac{\alpha}{\beta} := \chi^{MBD}.$$

The market price in the Greek market is

$$\delta(2\chi^{MBD}) = \frac{\alpha}{5} := \pi^{MBD}.$$

For the equilibrium to be interior we must have

$$\frac{a}{\alpha} > \frac{b}{5\beta},$$

i.e.,

$$u > h(s) := \frac{1}{5s}. \tag{16}$$

If $u \leq h(s)$, then in equilibrium $q^{MBD} = 0$ and $\chi^{MBD} = \frac{2}{5}\frac{\alpha}{\beta}$. The solid curve in Figure 3 below represents the function h and the area above the graph of h corresponds to the parameter constellations (s, u) for which the equilibrium is interior.

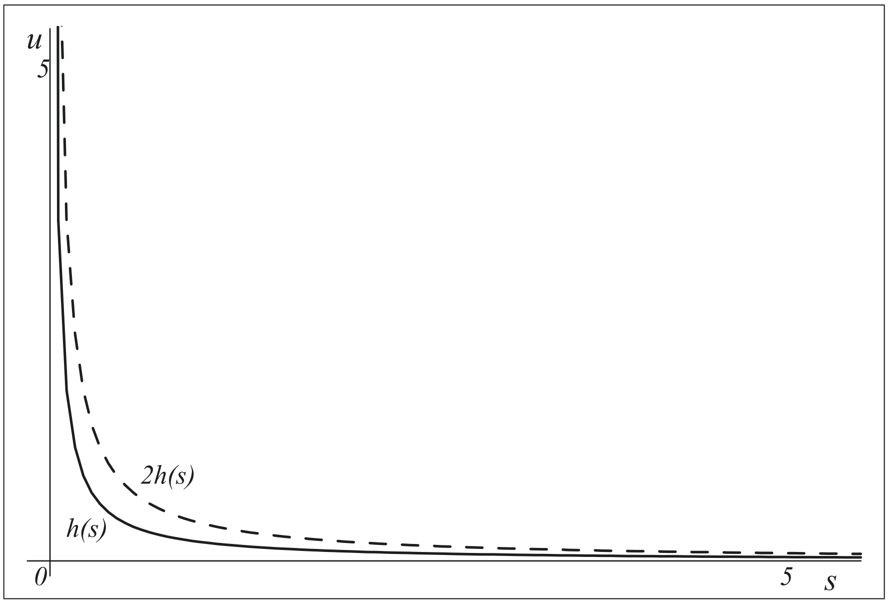

Figure 3. Total profits under MBD and NMB transfer pricing.

Using again (4) and (9), we can rewrite the expression for firms' output in the Latin market as

$$q^{MBD} = q^C - \frac{1}{5}\chi^C,$$

and the output in the Greek market as

$$\chi^{MBD} = \frac{6}{5}\chi^C.$$

Since $q^{NMB} = q^C$ and $\chi^{NMB} = \frac{6}{5}\chi^C$ by Proposition 1, then $q^{MBD} < q^{NMB}$ and $\chi^{MBD} = \chi^{NMB}$; that is, under MBD transfer pricing the output in the Latin (Greek) market is below (equal to) the output under NMB transfer pricing.

It is also interesting to compare the output under MBD and MB transfer pricing.

We have

$$\begin{aligned} q^{MB} - q^{MBD} &= \frac{4\alpha}{3\left(8b + 27\beta\right)}\left(u - \frac{3}{4}\right) + \frac{1}{5}\chi^{C} \\ &= \frac{4}{15}\frac{\alpha}{\beta\left(8b + 27\beta\right)}\left(2b + 3\beta + 5u\beta\right) \\ &> 0, \end{aligned}$$

i.e., $q^{MB} > q^{MBD}$. Also, propositions 1 and 2 and the results above imply $\chi^{MBD} > \chi^{MB}$. Hence the equilibrium outcome in the Latin (Greek) market is less (more) competitive under MBD than under MB transfer pricing; i.e., a lax application of the *ALP* makes competition softer (more aggressive) in the parents' (subsidiaries') market.

Discounts open up the possibility to gain a Stackelberg advantage in the Greek market, and bring back a prisoner's dilemma analogous to that firms face under NMB transfer pricing. Under MBD transfer pricing, however, parents' output decisions in the two markets are not independent: a parent by reducing its output in the Latin market and simultaneously increasing its discount, rises the marginal cost of its subsidiary's rival without affecting the marginal cost of its own subsidiary. Therefore, linking the cost of its subsidiary's rivals to the price in the Latin market makes competition more aggressive in the Greek market and less aggressive in the Latin market. In fact, when condition (16) does not hold, parents choose to completely shut down the Latin market. Note that a parent's incentive to reduce its output in order to increase the transfer price of its subsidiary's rival increases with both the maximum willingness to pay and the size of the Greek market relative to those of the Latin market. These results are stated in Proposition 5.

Proposition 5. *Under market based transfer pricing with discounts, the output in the Greek market is*

$$\chi^{MBD} = \frac{6}{5}\chi^{C} = \chi^{NMB} > \chi^{MB}.$$

Moreover, if $u > 1/5s$*, then the output in the Latin market is*

$$q^{MBD} = q^{C} - \frac{1}{5}\chi^{C} < q^{NMB},$$

satisfies $q^{MBD} < q^{MB}$*, and approaches* q^{C} *as* β *becomes large and/or* α *becomes small, and if* $u \leq 1/5s$*, then* $q^{MBD} = 0$.

Let us study profits under MBD transfer pricing. If $u > h(s)$, then the equilibrium is interior and we can calculate firms' profits in the Latin market under MBD transfer pricing using (8) as

$$\begin{aligned}\bar{\Pi}^{MBD} &= \frac{4a^2}{9b} + \frac{\alpha^2}{45\beta}\left(u - \frac{2}{5s}\right) \\ &= \frac{4a^2}{9b} + \frac{\alpha^2}{45\beta}\left(u - 2h(s)\right).\end{aligned}$$

Since, $\Pi^{MBD} = \Pi^{NMB}$, we have $\bar{\Pi}^{MBD} \lesseqqgtr \bar{\Pi}^{NMB}$ if and only if $u \lesseqqgtr 2h(s)$.

If $u \leq h(s)$, then in equilibrium $q^{MBD} = 0 < q^{NMBD}$ and $\chi^{MBD} = \frac{2}{5}\frac{\alpha}{\beta} = \chi^{NMB}$. Hence

$$\bar{\Pi}^{MBD} = \Pi^{NMB} < \bar{\Pi}^{NMB}.$$

Therefore $\bar{\Pi}^{MBD} < \bar{\Pi}^{NMB}$ if and only if $u < 2h(s)$. The dashed curve in Figure 3 displays the function $2h$. Parameter constellations (s, u) that lie above (below) this curve corresponds to those for which consolidated profits under MBD transfer pricing are greater than (less than or equal to) consolidated profits under NMB transfer pricing. This result is established in Proposition 6.

Proposition 6. *Consolidated profits under MBD transfer pricing are above (below) consolidated profits under NMB transfer pricing whenever u is above (below) $2h(s)$.*

Finally, we study the total surplus under MBD transfer pricing. If the equilibrium is interior, i.e., if $u > h(s)$, then the surplus in the Latin market is

$$W^{MBD} = W^{NMB} - \frac{2}{45}\frac{\alpha^2}{\beta}\left(u + \frac{1}{5s}\right).$$

Hence, $W^{MBD} < W^{NMB}$. Since $\Omega^{MBD} = \Omega^{NMB}$, we have

$$W^{MBD} + \Omega^{MBD} < W^{NMB} + \Omega^{NMB}.$$

In a corner equilibrium, i.e., when $u \leq h(s)$, we have $q^{MBD} = 0 < q^{NMB}$ and $\chi^{MBD} = (6/5)\chi^C = \chi^{NMB}$, and therefore

$$W^{MBD} + \Omega^{MBD} = 0 + \Omega^{NMB} < W^{NMB} + \Omega^{NMB}.$$

Hence total surplus under MBD transfer pricing is unambiguously below total surplus under NMB transfer pricing. This result is stated in Proposition 7.

Proposition 7. *Under market based transfer pricing with discounts, total surplus is unambiguously below total surplus under non-market based transfer pricing.*

In summary, market based transfer pricing with discounts generates a subtle link between markets that softens competition in the home market as each parent attempts to increase the transfer price of its subsidiary's rivals in order to gain a competitive advantage in the external market.

6 Conclusions

While a regulatory policy requiring that transfer prices be consistent with the Arm's Length Principle does not affect market outcomes under perfect competition, in imperfectly competitive markets with vertically separated firms it modifies the strategic nature of firms' interactions and ultimately has an impact on market outcomes. Specifically, the application of the ALP serves as a commitment device that softens competition. When the ALP is applied rigorously, the result is a softer competition in the subsidiaries' (external) market that is not compensated for by a more aggressive competition in the parents' (home) market. A laxer application of the ALP softens competition in the home market. Interestingly, vertical separation, an organizational structure whose motivation is not well understood in the absence of frictions, may be justified under transfer pricing policies based on the ALP.

References

[1] Alles, M., and Datar, S. (1998). Strategic transfer pricing. Management Science, 44(4), 451-461.

[2] Arya, A., and Mittendorf, B. (2007). Interacting supply chain distortions: The pricing of internal transfers and external procurement. The Accounting Review, 82(3), 551-580.

[3] Arya, A., and Mittendorf, B. (2008). Pricing internal trade to get a leg up on external rivals. Journal of Economics and Management Strategy, 17(3), 709-731.

[4] Baldenius, T., Melumad, N. D., and Reichelstein, S. (2004). Integrating managerial and tax objectives in transfer pricing. The Accounting Review, 79(3), 591-615.

[5] Baldenius, T., and Reichelstein, S. (2006). External and internal pricing in multidivisional firms. Journal of Accounting Research, 44(1), 1-28.

[6] Bernard, A. B., Jensen, J. B., and Schott, P. K. (2006). Transfer pricing by US-based multinational firms (No. w12493). National Bureau of Economic Research.

[7] Bernard, A. B., Jensen, J. B., and Schott, P. K. (2009). Importers, exporters and multinationals: a portrait of firms in the US that trade goods. In Producer dynamics: *New evidence from micro data*. University of Chicago Press.

[8] Choe, C., and Matsushima, N. (2013). The arm's length principle and tacit collusion. International Journal of Industrial Organization, 31(1), 119-130.

[9] Devereux, M.P., (2007). The impact of taxation on the location of capital, firms and profit: a survey of empirical evidence. Oxford University Centre for Business Taxation Working Paper 07/02.

[10] Dürr, O. M., and Göx, R. F. (2011). Strategic incentives for keeping one set of books in international transfer pricing. Journal of Economics and Management Strategy, 20(1), 269-298.

[11] Fershtman, C., and Judd, K. L. (1987). Equilibrium incentives in oligopoly. The American Economic Review, 927-940.

[12] Gal-Or, E. (1993). Strategic cost allocation. The Journal of Industrial Economics, 387-402.

[13] Göx, R. F. (2000). Strategic transfer pricing, absorption costing, and observability. Management Accounting Research, 11(3), 327-348.

[14] Hirshleifer, J. (1956). On the economics of transfer pricing. The Journal of Business, 29(3), 172-184.

[15] Keuschnigg, C., and Devereux, M. P. (2013). The arm's length principle and distortions to multinational firm organization. Journal of International Economics, 89(2), 432-440.

[16] Kreps, D. M., and Scheinkman, J. A. (1983). Quantity precommitment and Bertrand competition yield Cournot outcomes. The Bell Journal of Economics, 326-337.

[17] Lanz, R. and S. Miroudot (2011), "Intra-Firm Trade: Patterns, Determinants and Policy Implications", OECD Trade Policy Papers, No. 114, OECD Publishing, Paris. http://dx.doi.org/10.1787/5kg9p39lrwnn-en

[18] Lemus, A.B. and Moreno, D. (2019). Strategic Incentives for Keeping One Set of Books under the Arm's Length Principle, Universidad Carlos III de Madrid, working paper 19-??.

[19] Moreno, D., and Ubeda, L. (2006). Capacity precommitment and price competition yield the Cournot outcome. Games and Economic Behavior, 56(2), 323-332.

[20] OECD, (2017). Transfer Pricing Guidelines for Multinational Enterprises and Tax Administrations. OECD Publications Service, Paris.

[21] Sklivas, S. D. (1987). The strategic choice of managerial incentives. The RAND Journal of Economics, 452-458.

[22] Vickers, J. (1985). Delegation and the Theory of the Firm. The Economic Journal, 95, 138-147.